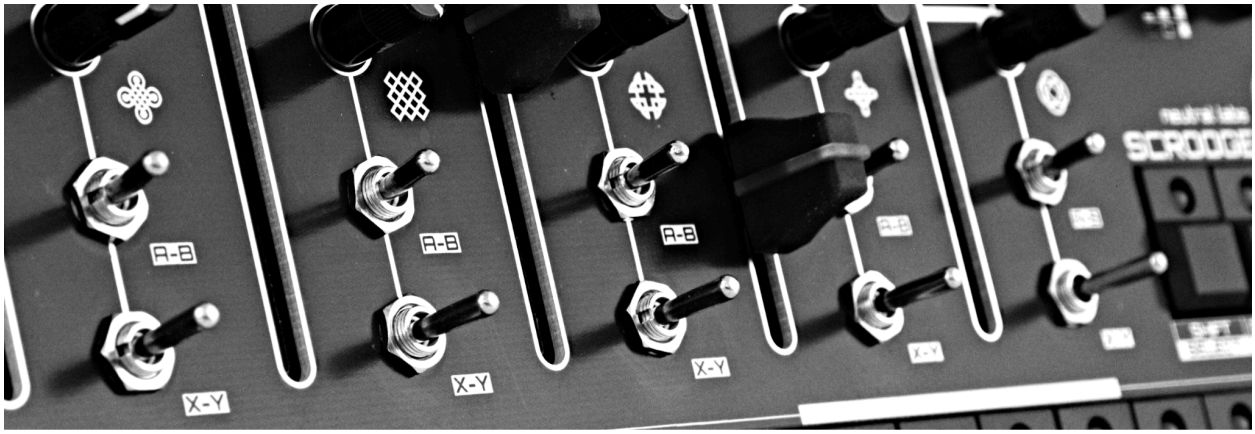
# SCROOGE v1.2

by neutral labs




## Manual

Hello, owner.

Scrooge is a sequenced malfunction generator, available as a Eurorack module or semi-modular desktop synth. While you can convince it to deliver boomy kick drum sounds, clicky hi-hats or metallic snares, it would much rather be making glitchy artifacts, hollow crackles and horribly distorted growls. It contains a sophisticated step sequencer with parameter locking and the possibility to control all steps across multiple tracks at once. Its 5 distinct and fully analog voices are made up of special circuits that work without dedicated power supplies, scrounging power from the sequencer control signals instead, which gives them an organic and unstable quality. As a bonus, it means you won’t have to power the unit itself if you sequence it from external gear.

## Specifications

- Width: 42 HP
- Supply voltage (either):
  - Eurorack 10-pin header: +12V/-12V
  - USB power: +5V
- Current draw (if used in powered mode):
  - Eurorack
    - +12V: typ. 75 mA, max. 100 mA
    - -12V: unused, 0 mA
    - 5V: unused, 0 mA
  - USB
    - typ. 120 mA, max. 200 mA
- **POKE**/**MOD** inputs: 0V to 12V usable, -12V to 12V max.
- **CLK** input: >1.8V pulse, -12V to 12V max., 4 or 1 PPQN configurable
- **RST** input: >1.8V pulse, -12V to 12V max.
- **MIDI** input: TRS type A (MIDI standard), 24 PPQN
- **A**/**B** audio output: 6V peak-to-peak, low impedance, headphone compatible
- **VOICE** audio outputs: 3V peak-to-peak, high impedance
- **EXT** output: 0V to 10V, 4 or 1 PPQN configurable (in EXT sync mode)

## Connecting Scrooge to USB power

Connect the provided USB-A-to-USB-C cable (or any other USB-C cable) to a USB power source, such as a USB power supply or a power bank. If you have previously removed the module unit from its case, make sure the internal power cable is once again correctly inserted into the white XH connector on the back of the board. Some USB power supplies can be noisy. Scrooge goes to great lengths to filter that noise, and most supplies should work well. **If you experience excessive hum or buzzing on the audio outputs, try another power supply or power bank.**

## Connecting Scrooge to Eurorack power

Connect a 10-pin Eurorack power cable to the 2x5 power header on the back of the module. **There are two 2x5 headers, one is marked OPTIONAL SEQ OUT. Do not use this header for power (which should not fit your power cable anyway) but the one marked EURORACK POWER. Otherwise you**

**will see the infamous magic smoke rise and the module will need repair.**

There is an arrow indicator next to the word **STRIPE** on the circuit board. Unsurprisingly, the red stripe side of the cable goes on the side that says **STRIPE**. The module (and your power supply) is protected in case you should ever connect it the wrong way around, it simply won't power up.

## First setup

If you don't enjoy reading manuals from start to finish, you should really make an exception for this one, since Scrooge does not work like your ordinary drum machine/synth/sequencer. If you're going to just dive in, at least be aware of this one thing:

**The control voltage curve generated by the sequencer for each track functions both as a gate that activates the voice, and as a time-variant signal controlling pitch, timbre and other sound characteristics.**

In any case, here's what you absolutely need to know to get going:

- Connect a **mono (not stereo)** audio cable from the **A** output socket to whatever device enables you to hear the sound (your mixer or output module, most likely). You can also use headphones (in which case a stereo plug is okay).
- Slightly turn up the **VOL** knob.
- Toggle all the **A-B** switches into the **A** position.
- Toggle all the **X-Y** switches into the middle (**-**) position.
- Power the unit via a USB-C cable or Eurorack power connector as described above.
- Press and immediately release the **RUN/START** button. The factory pattern will start to play and you should hear some sound.

A short intro to the buttons:

- As you may have guessed, the bottom row of 16 step buttons is used to turn steps on or off. Hold a button or number of buttons

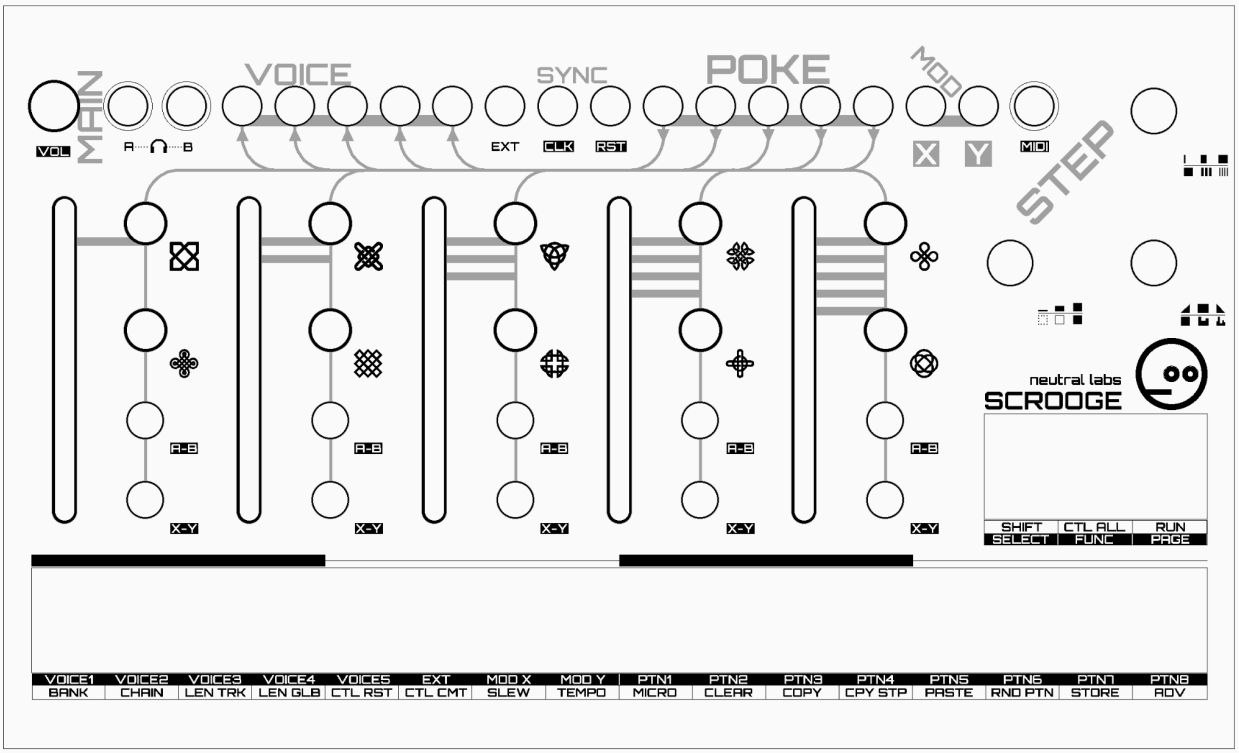
and turn the **STEP** knobs to alter the control voltage curve for that step.
- **SHIFT** (press and release the button) toggles between primary and secondary mode for the **STEP** knobs.
- **CTL ALL** (press and release the button) toggles **STEP** knob control for all steps on or off.
- **SELECT** (hold the button and press any of the 16 step buttons) enables you to select a different track or pattern (top row of text beneath the step buttons).
- **FUNC** (hold the button and press any of the 16 step buttons) enables you to access various functions (bottom row of text beneath the step buttons).

If you're feeling adventurous, follow these steps now (yes, this is a desperate attempt to make you keep reading, but I promise it's also a lot of fun):

- Press and release the **CTL ALL/FUNC** button to enter **CTL ALL** mode. The button LED should be lit.
- Press and release the **SHIFT/SELECT** button to access the secondary functions of the **STEP** knobs. The **SHIFT/SELECT** LED should be lit.
- Now turn the 3 **STEP** knobs in the top right corner to your heart's content. Note that the bottom left of those knobs adjust step probability, so turning it fully down will result in silence.
- You can at any time use the **CTL ALL/FUNC** button again to toggle **CTL ALL** mode off and return to the base pattern.
- You can create an algorithmically generated random pattern by holding the **CTL ALL/FUNC** button, then pressing and releasing step button 14 (labeled **RND PTN**). The button LED will flash, asking you to confirm, now simply press and release the button again.

In case any of this didn't work, check the **Troubleshooting** section at the very end. In case it did work, and you would like to be able to do more sophisticated adjustments to what you're hearing (it may admittedly just be horrible noise at the moment), keep reading. If you absolutely can't be bothered to, have at it and experiment. You won't break anything.

# Overview


MAIN
VOL
A
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VOICE
SYNC
EXT
CLK
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POKE
MOD
X
Y
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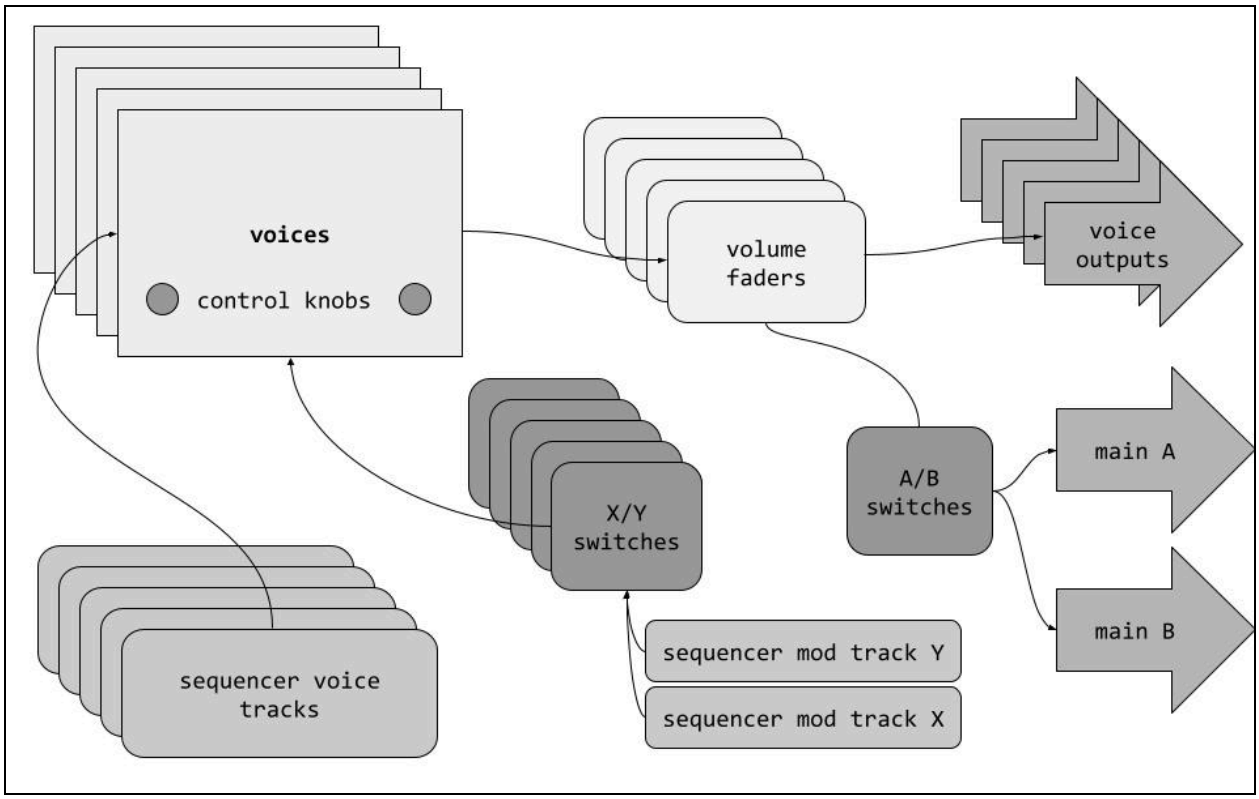
STEP
A-B
X-Y
neutral labs
SCROOGE
SHIFT
SELECT
CTL ALL
FUNC
RUN
PAGE
VOICE1 BANK
VOICE2 CHAIN
VOICE3 LEN TRK
VOICE4 LEN GLB
VOICE5 CTL RST
EXT CTL CMT
MOD X SLEW
MOD Y TEMPO
PTN1 MICRO
PTN2 CLEAR
PTN3 COPY
PTN4 CPY STP
PTN5 PASTE
PTN6 RND PTN
PTN7 STORE
PTN8 ADV


voices
control knobs
volume faders
voice outputs
X/Y switches
A/B switches
main A
main B
sequencer voice tracks
sequencer mod track Y
sequencer mod track X

## Voices

Scrooge has 5 voices, each with a different architecture, though they have one thing in common: They're constructed from CMOS chips combined with some analog circuitry. These chips are supplied with a voltage which may come from external gear, or more likely, from Scrooge's internal step sequencer. The voltage received on its power supply input puts the chip into action, but it's not a nice and steady voltage supply like you would have in a proper logic circuit that the chip was designed for. Instead the voltage level can be varied, or even follow a curve, which causes the now power-starved chip to output weird crackles, glitchy artifacts and occasionally, sounds that might almost make it pass for a drum machine.

- Voice 1 might be considered a kick drum voice by the proficient user, and a boomy weapon of mass confusion by anyone else.

- Voice 2 can deliver anything from a hi-hat to a bass drone, none of those very pleasant, but all extremely effective.

- Voice 3 would not be entirely offended if you called it a snare drum voice, although it offers much more.

- Growly and glitchy artifacts are the domain of voice 4, as is the ability to chirp like a kind of cyborg bird with a throat infection.

- Squelchy bass sounds have been heard from voice 5, but it can be convinced to enter low rumbling drum territory as well.

The nature of each voice's sound can be changed using 2 control knobs per voice, which are helpfully labeled with celtic knot symbols, so the exact function of each knob should immediately be apparent. If for some reason the user is not well versed in the field of interpreting the meaning of celtic symbols on obscure electronic instruments, a little hands-on experimentation should swiftly reveal the desired information.
Each voice has a dedicated volume slider with an LED indicator that lights up as the voice is activated, following the control voltage

curve. There is one 3-way **A-B** switch per voice, which routes the voice's audio output to either output socket **A** or **B** (or decouples it from the output if in the middle position, muting the voice). The mixer circuit will saturate when multiple voices are active at full volume, giving the sound a slightly crushed lo-fi vibe. If you want a clean mix instead, turn down the volume faders as needed or use the individual voice outputs.

The **A**/**B** outputs may be used with headphones, line level gear or Eurorack modules. The knob next to them adjusts the volume for both channels. You can use these outputs in different ways:

- Put different external effects on them, e.g. route voice 1 to output **A** and run it through a compressor or distortion, and send all other voices through a delay or reverb via **B**.
- Use **A**/**B** to form a stereo channel, with **A** on the left and **B** on the right.
- In a live performance setting, if you expect your listeners to value a bit of moderate sonic unruliness, but not tolerate it in excessive amounts, connect output **A** to the speakers and output **B** to your headphones in order to be able to cue/preview a voice before adding it to the main mix.

## Additional tracks

In addition to the 5 voice tracks, the sequencer offers one **EXT** track for sequencing external gear, and 2 modulation tracks, **MOD X** and **MOD Y**.

These modulation tracks can be routed to any of the voices using the **X-Y** switches present for each voice. In the middle position, no modulation input is connected to the voice. In the left position, **MOD X** is connected, and in the right position, **MOD Y** is connected. The **X** and **Y** LEDs follow the respective control voltage curves, in the same way as the voice LEDs on the volume sliders.

The specific effect of the modulation voltage depends on the voice. It may act like a filter, it may adjust the pitch or timbre, and in some cases you can even "play" the voice using just the modulation track.

When connecting several voices to the same modulation track, some cross-modulation effects will occur, which can lead to the discovery of happy little accidents.

Modulation control voltages can also be sent from external gear into the 2 **MOD** inputs, in which case they will replace the internally sequenced modulation tracks.

## Sequencer

Sequencer patterns are stored in flash memory. Each pattern contains track data for all 8 tracks (5 voice tracks, 1 **EXT** track and the 2 **MOD** tracks). Up to 64 steps per track are possible and the loop length can be freely chosen per track. The patterns are organised into 16 banks of 8 patterns each. Any changes made to a pattern are not immediately committed to flash memory, but must be explicitly stored, meaning you can always restore a pattern and undo the changes you made during a live performance.

The sequencer can be synced to external gear in various ways: The **EXT** output can be set to sync mode, in which case it will output a clock sync signal instead of a control voltage sequence. The **CLK** input can receive a clock sync signal, and the **RST** input can be used to reset all sequencer tracks to the initial step at once. There is also a **MIDI** input that will process MIDI clock and transport (start/stop) messages.

## Passive operation

Scrooge is designed to also work passively without a power supply. If you use it in this way, the internal step sequencer and the master **A** and **B** audio outputs will not be available. The voices can be activated by sending control voltages into the individual **POKE** inputs, and they will output audio signals from the individual **VOICE** outputs. **POKE** can be thought of as a combination of a gate with a control voltage signal that affects pitch, and timbre and other characteristics, depending on the voice. Sending an external audio source into a **POKE** input is often very rewarding. Modulation control voltages can be sent to the **MOD** inputs when used in passive mode.

Of course, the individual voice inputs and outputs will also work in powered mode. Note that the individual voice outputs are high-impedance outputs due to the passive nature of the circuitry, meaning that the audio volume and other sound characteristics will depend on the input impedance of the receiving module, effect or amplifier.

## STEP buttons

The row of 16 buttons is used to access the sequencer steps. It also has various secondary functions when used in combination with the **SHIFT/SELECT**, **CTL ALL/FUNC** or **RUN/PAGE** buttons as described further below. Note that while there are 16 step buttons, any track can be up to 64 steps long. In order to access additional sequencer pages beyond the first one, the **RUN/PAGE** button is used (described below).

In order to toggle a sequencer step between active and inactive, press and immediately release a step button. Active steps have their button LEDs lit up, inactive steps don't. In order to change a step's parameters, press and hold its button while using the **STEP** knobs as described below. This can also be done on an inactive step in order to activate the step and adjust its parameters at the same time.

Toggling steps active or inactive in this way, as well as adjusting their parameters, can also be done for multiple steps at once. In order to do this, simply press and release, or press and hold, the respective step buttons at the same time. If you want to adjust more steps than you have fingers on one hand, you could simply use additional body parts. Depending on the body part used and the attitude of your audience, this may not be well received, so there is also the **CTL ALL** function (described below) that allows you to change the parameters for all steps of a track or even several tracks. This can be used when programming a pattern, but also as a performance tool.

## STEP knobs

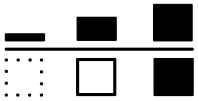
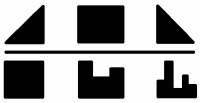
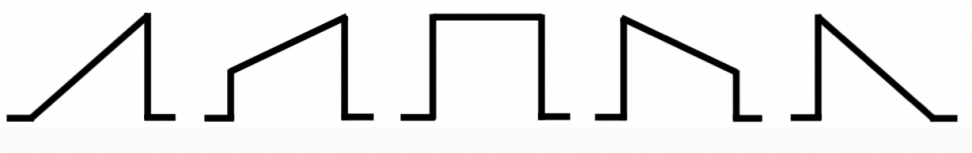
These 3 knobs are used to change the parameters of a single step's control voltage curve (while not in **CTL ALL** mode), or the parameters of a number of steps (while in **CTL ALL** mode). The resulting control voltage curve both activates the voice, like a gate, and sets a variety of sound characteristics like pitch, timbre or punchiness, depending on the voice.

In order to change the parameters for a single step, hold down a step button and turn any **STEP** knob or knobs as desired. The value of the changed parameter will be indicated by the step button LEDs as it is being changed. You may also hold down any number of step buttons simultaneously and change them all at once.

Each of the knobs has a primary and a secondary function. Their effect on the control voltage curve generated for a step is indicated by pictograms, and described in the table below.

The primary function is accessed while **SHIFT** is inactive (the **SHIFT/SELECT** button LED is unlit), and the secondary function is accessed while **SHIFT** is active (the **SHIFT/SELECT** button LED is lit). Press and immediately release the **SHIFT/SELECT** button in order to toggle **SHIFT** on or off.

Note that there is no guarantee that a step with the same parameters will sound exactly the same in all circumstances. Depending on the step or steps preceding it, the sound-generating circuits may be in slightly different states at the start of the step's control voltage curve, which can affect the pitch or timbre of the resulting sound. This can and should be exploited in order to create sonically interesting variety in a pattern.

| Knob | Description |
| --- | --- |
|  <br>**POKE**<br>**PROB/(TIME)** | **POKE** sets the control voltage for the step, from no voltage in the leftmost position to the maximum voltage in the rightmost position. Varying amounts of voltage will have different effects on the sound, depending on the voice and the settings of the voice's control knobs. Volume is affected, but also pitch, timbre and other characteristics, so feel free to experiment.<br><br>**PROB** sets the probability of the step being triggered, from 0% in the leftmost position to 100% in the rightmost position. The probability is evaluated each time the sequence reaches the step. Turning down the probability is especially useful when in **CTL ALL** mode, momentarily giving the whole sequence a sparse and random feeling.<br><br>If in microtiming mode (see **FUNC** menu table below), the secondary function of this knob sets the **TIME** parameter for the step instead of controlling the **PROB** parameter. In the leftmost position, the control voltage curve will commence immediately when the step is triggered (default). In the rightmost position it will start right before the next step would be triggered. In all positions in between, the curve starts at the corresponding time within the step. This allows you to trigger steps in between the step start times set by the grid. |
|  <br>**TILT**<br>**MELT** | **TILT** adjusts the slope of the control voltage. With this parameter in the middle position, the voltage acts like a simple on/off gate that goes from zero to the maximum voltage set by **POKE** immediately, and then back down to zero after the time set by **GATE** has passed.<br><br>  <br><br>In the leftmost position, the voltage increases linearly from zero, reaches the maximum voltage only at the end and then drops to zero immediately, like a rising sawtooth wave. In the rightmost position, the curve described by the voltage is reversed, dropping off linearly from the maximum at the start of the step to zero at the end of it, like a falling sawtooth wave. For all settings in between, the |

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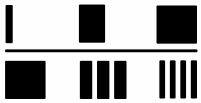
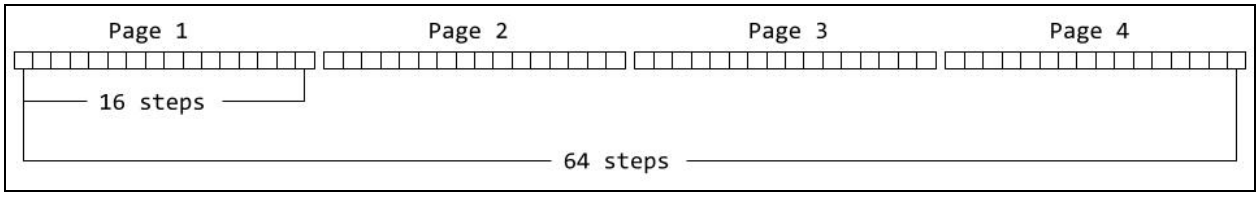
| | start or end voltage is increased or lowered accordingly, so the increase will not start from zero, or the drop off will not go all the way to zero.<br><br>**MELT** erodes the control voltage curve using digital bit mangling operations. The result is an abrasive sound not unlike that achieved by frequency modulation (FM). Voices and modulation tracks really open up a lot more sonic possibilities using **MELT**, so feel free to experiment. If desired, **MELT** may lead to utter sonic destruction when combined with **CHOP**. |
|  <br>**GATE**<br>**CHOP** | **GATE** sets the length of the control voltage curve for the step. In the leftmost position, the length is shortest, and in the rightmost position, it's at its longest. The maximum gate time corresponds to the length of 8 full steps. The length scales with the current tempo. Overlapping active steps are possible, in this case a new step curve will take over from the previous one. This mechanism can be used in combination with **PROB** to create some variation in a static pattern.<br><br>**CHOP** introduces a ratcheting-like effect: The control voltage is set to zero at short regular intervals, splitting a single step's curve into several chunks. In the leftmost position, the effect is disabled. Increasing it, chopping starts and the ratcheting time is longest, with the curve being split into 2 chunks, from there increasing to 3, 4 and so on, which can feel like a bit of an echo effect at this point. Increasing the knob position, the ratcheting frequency eventually reaches the audio range, which introduces some tonality into an otherwise atonal voice.<br><br>**CHOP** is very useful when performing in **CTL ALL** mode. It creates harsh noise and all kinds of weirdness when used across several tracks at once, which can be employed to create a dramatic crescendo before suddenly returning to the base pattern. |

## RUN/PAGE button

Press and immediately release the **RUN/PAGE** button in order to start or pause the sequencer. When starting a once paused sequence, the sequencer will pick up from where it was last paused, and not necessarily from the first step. In order to reset all sequencer tracks to the first step, hold the **CTL ALL/FUNC** button, then press and immediately release the **RUN/PAGE** button (or alternatively, use the **RST** input with an external trigger).

Press and hold the **RUN/PAGE** button, and the first 4 step LEDs will light up indicating the 4 sequencer pages. One of the LEDs will blink, indicating the current page.




Press any of those 4 step buttons, then let go of the **RUN/PAGE** button in order to switch to a page. You can switch to any page, even those that are beyond the current track length. This enables you to set a longer track length or global length as described in the **FUNC** menu table under **LEN TRK** and **LEN GLB**.

During a live performance, you may be anxious about accidentally hitting the **RUN/PAGE** button and stopping the sequencer. To prevent this, engage locked run mode by holding the **SHIFT/SELECT** button and then pressing and releasing the **RUN/PAGE** button to start the sequencer. Started in this way, the sequencer will only stop when you perform the same gesture again.

If you are syncing to an external sync or MIDI signal and want to use locked run mode, first enter locked run mode by using the button combination, then stop and reset the sequencer on the device you are syncing from (most likely by pressing the stop button) and then start the sequencer again on the same device. Both devices should now be in sync with the **RUN/PAGE** button locked.

## SHIFT/SELECT button

Press and immediately release the **SHIFT/SELECT** button in order to turn **SHIFT** on or off. The button LED will indicate the **SHIFT** status. While **SHIFT** is active, the **STEP** knobs will adjust their secondary parameters as described under **STEP knobs**.

In order to access items from the **SELECT** menu (tracks and patterns), press and hold the **SHIFT/SELECT** button, then press and release any of the 16 step buttons, then let go of the **SHIFT/SELECT** button. The items accessible by **SELECT** are indicated by the top row of text below the 16 step buttons.

The first 8 buttons are used to select a track (while not in **CTL ALL** mode) or a number of tracks (while in **CTL ALL** mode). The currently selected track or tracks are indicated by blinking LEDs and the unselected tracks by lit LEDs. The first 5 step buttons correspond to the 5 voice tracks, button 6 corresponds to the **EXT** track for external sync or sequencing, and buttons 7 and 8 correspond to the **MOD X** and **MOD Y** modulation tracks. You can use this function regardless of whether the sequencer is stopped or running.

The other 8 buttons are used to switch to a new pattern, or reload the original state of the current pattern from flash memory. Available patterns for the current bank are indicated by a lit LED. (See **BANK** in the **FUNC menu** table if you want to switch banks.) The current pattern is indicated by a blinking LED. You can use this function regardless of whether the sequencer is stopped or running. Note that switching to a new pattern does not reset the **CTL ALL** parameters. Use the **CTL RST** command to do that.

## CTL ALL/FUNC button

Press and immediately release the **CTL ALL/FUNC** button in order to turn **CTL ALL** mode on or off. The button LED will indicate the **CTL ALL** mode status. While **CTL ALL** mode is active, the **STEP** knobs will affect not just a single step, but all steps across all currently selected **CTL**

**ALL** tracks. This functionality may be used whether the sequencer is currently playing or not.

In order to select these **CTL ALL** tracks, enter **CTL ALL** mode and use the **SHIFT/SELECT** button to add or remove tracks from **CTL ALL** as described under **SHIFT/SELECT** button. By default, voice tracks 1-5 are selected.

Note that the changes made in **CTL ALL** mode are not automatically stored in flash memory, but can either be reverted or committed to the currently playing pattern, which is very useful in a live performance setting. This is described in the **FUNC** menu table below, under **CTL RST** and **CTL CMT**.

If you want to enter **CTL ALL** mode and simultaneously set the **CTL ALL** tracks to just the current track, hold the **SHIFT/SELECT** button while pressing and releasing the **CTL ALL/FUNC** button. Exit **CTL ALL** mode normally when done. This is useful when wanting to edit several steps on a single track to the same parameters.

If you want to prevent accidentally stopping the sequencer while toggling **CTL ALL**, refer to locked run mode as described under **RUN/PAGE button**.

In order to access the **FUNC** menu options, press and hold the **CTL ALL/FUNC** button, then press and release one of the 16 step buttons, then let go of the **CTL ALL/FUNC** button. The items accessible by **FUNC** are indicated by the bottom row of text below the 16 step buttons, and described in the table below.

| **Function** | **Description** |
|---|---|
| **BANK** | Use this to select the current bank of patterns. There are 16 banks to choose from. All 16 step LEDs will light up, with the current bank LED blinking. Now press and release the button of the bank you want to go to. The pattern that corresponds to the current pattern number in the selected bank will be loaded when switching banks. |
| **CHAIN** | Chain mode allows you to chain several patterns, all of which must be in the same bank. The **PTN** button LEDs for all |

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| | available patterns will light up and the step button 2 LED will be blinking.<br><br>Press and release any **PTN** button, then press and release additional buttons in your desired order. Patterns may be repeated in the chain. Up to 32 entries can be made. To cancel, press and release the blinking **CTL ALL/FUNC** button at any time. To finish and save, press and release step button 2. The chain is now saved and when the sequencer is running, the chained patterns will be played in the desired order, looping the whole chain over and over.<br><br>In order to exit chain mode and return to normal pattern play, simply load any single pattern. Note that the chain is not stored in flash memory. |
| **LEN TRK** | This is used to set the loop length of the current track or of several tracks at once. In **CTL ALL** mode, this setting affects all controlled tracks, otherwise it affects the current track only.<br><br>The step LEDs will light up and indicate the current length with all LEDs up to the length being lit and the LED that corresponds to the length blinking. Note that the indicator shown depends on the current step page, so if e.g. the length is 21 and you're on page 2, LED 5 will blink, whereas when you're on page 1, all LEDs will be lit and none will blink, and on page 3 or 4, none will be lit at all. Use the **RUN/PAGE** button to go to the desired page before setting the length.<br><br>Use the **CTL ALL/FUNC** button to cancel. The maximum track length is 64 steps. The default track length is 16 steps. |
| **LEN GLB** | This sets the global length for the current pattern. The mechanism used is the same as the one described in **LEN TRK**. Global length, if set, is the point at which all tracks of the pattern are reset to the first step, starting a new loop. This can be useful if several tracks have independent lengths, e.g. voice 1 has length 17 and voice 2 has length 5, but you still want to reset them all at once after a specific number of steps. Use the **RUN/PAGE** button to go to the desired page before setting the length. Use the **CTL ALL/FUNC** button to cancel. The maximum global length is 64 steps. To disable global length for the current pattern, press and release step button 1 while in this mode. By default, global length is disabled. |

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| **CTL RST** | Use this to revert the changes made in **CTL ALL** mode. Note that this does not reset the pattern to the state stored in flash memory. In order to do that instead, simply reload the pattern by holding the **SHIFT/SELECT** button and pressing the button corresponding to the current pattern number. |
| **CTL CMT** | This commits the changes made in **CTL ALL** mode to the current pattern, meaning the pattern will preserve those changes even after leaving **CTL ALL** mode. Using this function, you can easily edit several steps at once. Note that this does not automatically store those changes to flash memory. In order to do that, use the **STORE** function to store the whole pattern. |
| **SLEW** | A slew limiter for the current track or for several tracks. In **CTL ALL** mode, this setting affects all controlled tracks, otherwise it affects the current track only. This limits the rate of change for the control voltage sent to the voice or modulation track, meaning at a lower setting sharp increases or decreases in voltage will be smoothed out.<br><br>The step LEDs will light up indicating the current setting. The default is 16 (no slew limiting). Press and release any step button to change the setting. Alternatively, use the **POKE/PROB** knob to continuously adjust the setting and press and release any step button or the blinking **CTL ALL/FUNC** button to exit. If you've used the knob to adjust the setting, any step button will simply exit and not further change the slew setting. |
| **TEMPO** | This sets the current tempo. The step LEDs will light up indicating the current setting. Press and release any step button to change the tempo. Alternatively, use the **POKE/PROB** knob to continuously adjust the tempo and press and release any step button or the blinking **CTL ALL/FUNC** button to exit. If you've used the knob to adjust the setting, any step button will simply exit and not further change the tempo. In order to precisely adjust the tempo, the knob should be used, as the buttons provide a much less granular control.<br><br>Note that any sync data received via the **CLK** or **MIDI** inputs supersedes the manually set tempo. Also note that the tempo is not stored with a pattern, meaning you can switch between patterns without incurring a tempo change. However, Scrooge will remember the last tempo set before power down. |

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| **MICRO** | Toggles microtiming mode. In this mode, the secondary function accessible by the **POKE/PROB** knob sets the microtiming for the step. Refer to the **STEP knobs** section for a detailed explanation. While holding the **CTL ALL/FUNC** button, the microtiming mode status is indicated by the LED (lit means on, flashing means off). |
| **CLEAR** | Clears (deletes all steps for) the current track or for several tracks. In **CTL ALL** mode, this setting affects all currently controlled tracks, otherwise it affects the current track only.<br><br>Note that this does not overwrite the current pattern as stored in flash memory. In order to do that, use the **STORE** function to store the pattern. |
| **COPY** | This can be used to copy a track or pattern. The step button LEDs will light up, indicating the tracks and the patterns contained in the current bank.<br><br>If a track button is pressed and released, this track will be copied to the clipboard.<br><br>If a pattern button is pressed and released, this pattern will be copied to the clipboard.<br><br>Note that tracks will be copied from working memory, so any changes made will be copied as well. The track length will not be copied. Whole patterns will be copied from flash memory, without any of your unsaved changes. Copying a pattern preserves all track lengths.<br><br>Use the **PASTE** function to paste a track or pattern from the clipboard. |
| **CPY STP** | Use this to copy a single step. All active steps will blink. Press and release any step button to copy all the associated step data into the clipboard. Use the **PASTE** function to paste a step from the clipboard. If you intend to use this functionality to create several identical steps, note that the same result can possibly be achieved quicker by using **CTL ALL** mode with a subsequent **CTL CMT** command.<br><br>Note that the step being copied does not have to be active, meaning you can copy steps with their LEDs being unlit. Those steps will also be inactive when pasted. |

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| **PASTE** | If the clipboard contains a pattern, track or step after using the **COPY** or **CPY STEP** commands, use this to paste the data from the clipboard.<br><br>If the clipboard contains a pattern, this pattern will be pasted and the current pattern will be overwritten, though not stored to flash memory.<br><br>If the clipboard contains a track, the current track will be overwritten, though the changes will not get stored to flash. The track length will remain unchanged.<br><br>If the clipboard contains a step, all active steps will blink and the clipboard step will be pasted into any position by pressing and releasing the corresponding step button. Note that you may select either a currently active or a currently inactive (non-blinking) step as the target.<br><br>Use the **CTL ALL/FUNC** button to cancel pasting if needed.<br><br>Note that pasting a pattern does not reset the **CTL ALL** parameters. Use the **CTL RST** command to do that. |
| **RND PTN** | Use this to generate random pattern data. The step 14 button and the **CTL ALL/FUNC** button will both blink. Press and release the former to confirm, or the latter to cancel.<br><br>In random pattern mode (default), running the **RND PTN** command will generate a new pattern from scratch. An algorithm will fill voice tracks 1-5 as well as the two **MOD** tracks with random data, up to their current length. The data is not fully random, rather the algorithm will attempt to make something that is rhythmically interesting.<br><br>In evolve mode, a random variation based on the current pattern will be generated. Evolutions are always based on the pattern in working memory, not the pattern as stored in flash memory, so running this command repeatedly will deviate more and more from the original. Only the 5 voice tracks will be altered, not the **EXT** or **MOD** tracks.<br><br>See **ADV functions** on how to toggle between the two modes.<br><br>You can use this function while a pattern is playing. The pattern or evolution will replace the current pattern, but won’t be stored in flash memory. In order to save it, use the **STORE** function described below. |

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| **STORE** | This stores the current pattern in flash memory, including all modifications that have been made after the pattern was last loaded. The step button for the current pattern and the **CTL ALL/FUNC** button will both blink, the step buttons for all other patterns of the current bank will be constantly lit. Press and release any of those step buttons to store the pattern in this location, or the **CTL ALL/FUNC** button to cancel. If you store to another location than the current pattern, the sequencer will not automatically switch over to the newly stored pattern, but remain on the current one.<br><br>Note that you cannot store a pattern to another bank, however, you can copy/paste it to another bank, see **COPY** and **PASTE** in this table.<br><br>You can use this function while a pattern is playing. Note that any changes made in **CTL ALL** mode are not stored unless the **CTL CMT** command has been used before, committing those changes to the pattern. |
| **ADV** | Some advanced functionality is available by using this function. See table **ADV functions**. |

## ADV functions

In order to access these advanced menu options, press and hold the **CTL ALL/FUNC** button, the press and release step button 16 (**ADV**), then let go of the **CTL ALL/FUNC** button. The available **ADV** function button LEDs will blink or be lit. Press and release any one of those step buttons to enter the desired function. Press and release any non-blinking, non-lit step button or the blinking **CTL ALL/FUNC** button to cancel.

| Step button | Description |
|---|---|
| **1** | **Factory reset:** This resets all device configuration and deletes all steps from all patterns of all banks. It also clears the current pattern in working memory. The initial factory pattern 1 on bank 1 will be restored.<br><br>The operation needs to be confirmed by a second press and release of the blinking step 1 button. To cancel, press any other step button or the blinking **CTL ALL/FUNC** button. |

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| | The reset procedure takes about 15 seconds and its progress will be indicated by the step LEDs. It is not advisable to turn off the power during this time. After the procedure has finished, Scrooge will reboot into the factory state.<br><br>Note that this does not restore the original firmware version. In order to do that, follow the firmware update procedure (downgrades are supported, though all stored patterns may be lost). |
| **2** | **Display firmware version:** The current firmware version will be indicated by a number of step button LEDs. The first 8 buttons correspond to the major version number, and buttons 9-16 to the minor version number, e.g. buttons 1 and 9 being lit means version v1.1, and buttons 1, 2, 9, 10 and 11 being lit would indicate v2.3. Press any step button to exit. |
| **6** | **EXT sync mode:** This toggles between **EXT** sync mode active (LED on) or inactive (LED blinking). When active, the **EXT** sequencer track will be disabled and instead, a clock signal will be present on the **EXT** output, which can be used to synchronize Scrooge to external gear.<br><br>This setting is saved to flash memory and recalled at device power up. |
| **7** | **PPQN resolution:** This toggles between 4 PPQN (LED blinking) and 1 PPQN clock (LED on). The setting is used for both outgoing and incoming clock signals. Note that the **MIDI** port is unaffected, it always expects 24 PPQN signals.<br><br>This setting is saved to flash memory and recalled at device power up. |
| **8** | **SYNC soft/hard:** Toggles between hard (LED lit) and soft external sync (LED blinking), hard meaning once an external clock or MIDI signal has been seen, the sequencer will not restart on its own after the signal has been lost. |
| **14** | **RND mode:** This toggles between random pattern mode (LED blinking) and evolve mode (LED on). In random pattern mode (default), running the **RND PTN** command will generate a new pattern from scratch. In evolve mode, a random variation based on the current pattern will be generated instead. This setting is saved to flash memory and recalled at device power up. |

# Syncing Scrooge to external devices

Scrooge will send a clock signal to external devices via the **EXT** output if the sequencer is running and **EXT sync mode** is enabled. In this case the **EXT** sequencer track will be disabled. See **EXT sync mode** in the **ADV functions** table. The clock resolution is configurable between 4 PPQN and 1 PPQN, see **PPQN resolution** in the **ADV functions** table.

In order to receive clock signals from external devices, the **CLK** input or the **MIDI** input (for MIDI clock signals) can be used. A clock signal on either of them will be automatically detected and indicated by the **RUN/PAGE** button LED flashing in sync while the sequencer is running. Any external clock signal will supersede the sequencer's internal clock. **CLK** and **MIDI** should not be used concurrently. It won't break anything, but it will be weird, and we don't want Scrooge to sound weird now, do we?

Once the unit detects that it's being clocked from an external source, it will attempt to stay with the clock's rhythm. In case the sync pulse stops or the cable is disconnected, the device will naturally experience some confusion. If you want Scrooge to resume playing using the internal clock, wait a little, or hit the **RUN/PAGE** button a couple of times for emotional support, and it will eventually be convinced.

The **CLK** input expects a 4 PPQN or 1 PPQN sync pulse. The resolution is configurable, see **PPQN resolution** in the **ADV functions** table. There is also a reset (**RST**) input to reset all sequencer tracks to their initial steps.

The **MIDI** input is used with a TRS type A plug (MIDI standard) and expects a 24 PPQN resolution clock, as commonly used by most MIDI devices. If a MIDI clock signal is present, Scrooge will also react to MIDI transport messages and start/stop/reset the sequencer accordingly.

# Tips and Tricks

Here are some random tips and tricks that might not be super obvious:

- While performing in **CTL ALL** mode, turn down the **PROB** parameter on all tracks to momentarily give the pattern a sparse feeling. Likewise, you can turn down **GATE** so all steps will be short blips, or turn it up to a powerful crescendo before disabling **CTL ALL** and returning to the original pattern.

- Use random variation mode (see **ADV functions**) while performing in order to generate variations on the current pattern, and then return to the original pattern by reloading it.

- Using **CHOP** at higher settings, harmonic step pitches are possible, and with some practice, this can be used to great effect across several voices while in **CTL ALL** mode.

- Try using **CTL ALL** while controlling only the **MOD X** and **MOD Y** tracks. Increase **GATE** and either **CHOP** or **MELT** while playing with **PROB** in order to insert random glitches into the sequence.

- With the sequencer not running, send various types of audio signals into the **POKE** inputs to generate nasty drones. Another fun idea is to trigger an external voice via the **EXT** track and send its audio through one of Scrooge's own voices.

- Slow the tempo way down, use long **GATE** lengths and adjust the **SLEW** limiter down to turn Scrooge into a drone machine with synced modulation. Bonus for different track lengths.

- As any new step will replace the currently playing one, here's a trick you can use in order to play one of two different steps at random: Create 2 steps right next to each other. Set the **TIME** parameter of the earlier one to maximum. This means it will effectively be played at the same time as the later one. Now turn down the **PROB** parameter of the later step. Any time this step isn't played, the other one will play at the same time instead.

## Firmware upgrade

In order to upgrade the firmware, unzip the archive and locate the update file (suffix UF2). Remove the module from the Eurorack or desktop case. Plug a Micro-USB cable into your computer. While holding the UPDATE button on the back of the module, plug the other end of the cable into the Micro-USB port next to the UPDATE button. Let go of the button. A drive should appear on your computer. Copy the UF2 file onto the drive. The drive will disappear and Scrooge will reboot. Now place the module back into the case. A firmware upgrade will not delete any patterns or configuration.

## Troubleshooting

| **Problem** | **Possible Solution** |
|---|---|
| The unit doesn't turn on. | For the Eurorack version, make sure the power cable is properly connected and in the correct orientation.<br><br>For the desktop version, make sure the cable is fully inserted on both sides. Check whether your power supply works with other gear. If needed, remove the 4 panel screws and inspect the internal power connection that goes from the USB-C socket on the back of the case to the XH connector on the circuit board. |
| There is no sound from the **A** or **B** output socket. | Check whether one or more voice tracks are actually routed to the respective output, and they're also generating sound. The volume fader should be in the upper position. Test using the individual outputs if needed.<br><br>Make sure the audio output jack is fully inserted on both sides and the volume control is turned up. Test whether your speaker/mixer/effect on the output side works with other gear. |
| The **EXT** track is not working. | You probably have **EXT** sync mode activated, see the table under **ADV functions**. |
| The sequencer won't stop running. | You may have engaged locked run mode (described in the **RUN/PAGE button** section). Hold the **SHIFT/SELECT** button and press and release the **RUN/PAGE** button to stop. |

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| The sequencer is playing, but no steps are displayed. | You may be on a page that does not contain any steps for this track. Switch to page 1 by holding the **RUN/PAGE** button and then pressing and releasing step button 1. |
| A track is not making any sounds. | Check the **SLEW** setting, it might be turned down. You may also want to make sure the **PROB** parameter is not too low. |
| The control knobs have little effect. | This can be normal, depending on the track and control voltage. Change the step parameters to introduce more tonal variety. |
| Slew limiting even a tiny bit makes a track go silent. | Steps that make heavy use of the **MELT** and/or **CHOP** parameter may be silenced entirely when **SLEW** is used, since their control voltage curves experience extremely fast up and down movements in quick succession, and the slew limiter will smooth those curves out so much that no audio signal is generated. |
| A step sounds different every time it's played. | Some variation is always to be expected due to the nature of the sound-generating circuits, and the resulting uncertainty should ideally be embraced by the user.<br><br>If the result seems particularly severe, check if modulation via the **X** or **Y** track is enabled across several voices, and see if the issue persists when disconnecting the **MOD** tracks. You might also have a step with probability somewhere close, and depending on whether that's triggered or not, it will affect the erratic step in different ways. |
| There is a constant hum or buzz on the audio outputs. | Make sure you're using a mono cable, not a stereo one. (Stereo plugs are okay if using headphones.)<br><br>If the problem is present with a mono cable while using USB to power the unit, this is most likely due to the power supply. Scrooge goes to great lengths to filter out the noise of all but the nastiest phone chargers. It's best to try another power supply, a battery pack, or a USB port from a laptop or phone. |
| It does not sound like a drum machine. | Regular meditation exercises may help cultivate the gift of acceptance. If the problem persists, it can be fixed by obtaining a vintage, mint-condition 808. |